DISPENSER WITH APPLICATOR MODULE FOR APPLYING ADDITIONAL ELEMENTS TO DISPENSED TAPE

CROSS-REFERENCE TO RELATED APPLICATION(S)

This application claims the benefit of U.S. Provisional Application No. 60/422,562 filed 10/31/02, which is incorporated by reference herein in its entirety.

BACKGROUND

1. Field of the Exemplary Embodiments of the Invention

The exemplary embodiments of the present invention relate to dispensers for dispensing sheet or tape materials and, more particularly, to such dispenser capable of combining two or more tape materials during dispensing or of adding another element to the material being dispensed.

2. Brief Description of Related Developments

Conventional flat sheet or tape material dispensers for dispensing tape or sheet material in a ready to use condition, such as for example case sealers, or tabletop tape dispensers and even handheld tape dispensers, generally dispense the material that has been otherwise preformed and wound in a roll to await dispensing. Other than merely dispensing the material from the roll, conventional dispensers generally do not modify or change the characteristics of the dispensed material except possibly, for example in the case of tape dispensers, actuating the adhesive on the dispensed tape or similar minor changes. There are some conventional dispensers that during dispensing of the sheet/tape material are capable of adding a further material to the material being dispensed. One example of such a dispenser is

disclosed in U.S. Patent No. 4,869,769, wherein an apparatus applies pull tabs to two ends of the sealing courses of pressure sensitive tape dispensed by the apparatus. Another example is disclosed in U.S. Patent No. 3,878,013, wherein a taping apparatus applies a band of tape around an article. The band of tape is an assembly that initially comprises two parts fed from two supply rolls and assembled in the apparatus before being applied to the article. As seen from the above noted examples, even in conventional dispensers capable of adding a further material to the tape or base material being dispensed, the material being added is always the same material. However, there is a desire amongst users of material dispensing devices, such as tape dispensers, to be able to dispense tape having different characteristics while using the same dispenser and but a single base tape material. For instance, in the case of commercial packager and shippers there is a desire for a tape dispenser, be it a case sealer, a portable countertop dispenser or handheld dispenser, capable of dispensing different tape while using a single type of base tape. This would enable the user to purchase but a single type of base tape and yet be able to tailor the dispensed tape to a given container or application as desired. This in turn would eliminate having to procure different tapes for specific applications as with conventional dispensers. The dispensers according to the exemplary embodiments of the present invention overcome the problems of conventional dispensers as will be described further below.

SUMMARY OF THE EXEMPLARY EMBODIMENTS

In accordance with an exemplary embodiment of the present invention, a dispenser for dispensing a length of tape ready for application on a package is provided. The dispenser includes a frame, a feed mechanism, a cutting mechanism, and an applicator. The frame has a storage area for storing tape therein. The feed mechanism is connected to the frame for feeding tape from the storage area. The cutting mechanism is connected to the frame for cutting the length of tape dispensed from the dispenser. The applicator is connected to the frame and adapted for applying an additional element to the tape when the length of tape is dispensed. The application of the additional element to the tape provides the length of tape with a predetermined characteristic. The additional element applied by the applicator is selected from a number of different additional elements. Each additional element has a different predetermined characteristic so that when applied to the tape, each of the different additional elements provides the length of tape with a different corresponding predetermined characteristic.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing aspects and other features of the present invention are explained in the following description, taken in connection with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a sealing system incorporating features in accordance with one exemplary embodiment of the present invention and a package A used with the sealing system;

Fig. 1A is an enlarged partial perspective view of the package A with a tape 100A dispensed by the system in Fig. 1 applied to the package;

Fig. 2 is a schematic partial elevation view of a tape application head portion of a dispenser of the sealing system in Fig. 1;

Figs. 3A-3B are respectively front and side elevation views of a cutting blade of the head portion in Fig. 2;

Figs. 4A-4B are respectively an exploded partial perspective view, and plan view of a tape used with the system in Fig. 1 in accordance with one exemplary embodiment;

Figs. 5A-5E are respectively an exploded perspective, another perspective, a first elevation, a second elevation, and a plan view of another tape used with the system in Fig. 1 in accordance with another exemplary embodiment;

Fig. 6 is a schematic perspective view of a sealing system in accordance with another exemplary embodiment of the present invention;

Figs. 7A-7B are respectively partial perspective views of part of the sealing system in Fig. 6 seen from opposite directions;

Fig. 8 is a partial elevation view of part of the sealing system in Fig. 6;

Figs. 9A-9B are respectively a perspective view and an exploded perspective view of a removable module of the sealing system shown in Fig. 6;

Fig. 10 is a schematic elevation view of a sealing system in accordance with another exemplary embodiment; and

Fig. 11 is a schematic elevation view of a sealing system in accordance with yet another exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

Referring to Fig. 1, there is shown a perspective view of a sealing system or dispenser 10 incorporating features in accordance with an exemplary embodiment of the present invention, and a package or container A sealed using the dispenser. Although the present invention will be described with reference to the exemplary embodiments shown in the drawings, it should be understood that the present invention can be embodied in many alternate forms of embodiments. In addition, any suitable size, shape or type of elements or materials could be used.

The dispenser is illustrated in Fig. 1, for example purposes only, as being a case sealing system, and will be described below with particular reference to the case sealing system. However, the present invention is equally applicable to any other suitable type of dispenser or sealing system. As seen in Fig. 1, the case sealing system 10 generally comprises case sealing apparatus 11 and tape 100. The apparatus may include frame 300, transport system 400, tape dispensing system 500 and a controller 600 with a user interface. The controller 600 may be mounted to the frame or may be remote connected to the apparatus via a suitable communication network (not shown) such as for example a LAN, the internet or any other suitable communication system. The case sealing system 10 operates to automatically seal with tape 100 open seams of containers, cartons, or packages placed in the case sealing apparatus 11. Fig. 1 shows the case sealing system with an exemplary package or container A.

Package A, as shown in Figure 1A, may be for example a carton having a general hexahedron shape. Package A may have at least two generally rectangular flaps B, C on at least one side D. When flaps B and C are folded closed, a seam E' is formed between the flaps. Seams B', C' are also formed between the folded flaps B, C and one or more of the adjoining sides E of package A. In alternate embodiments, package A may be of any other suitable type or configuration, for example, an envelope, container, carton, etc. that may require sealing.

The frame 300 generally has a lower support section 302, a mid-section 304 and an upper section 306. As see in Fig. 1 the lower section 302 may comprise a number of

legs/columns and support struts, or any other suitable support structure, to support the apparatus 11 from a suitable support surface. The mid-section 304 stands atop the lower section 302 and in this embodiment includes suitable structural sections to mount and support the transport system 400 to the frame as will be described in more detail below. The upper section 306 of the frame extends from the mid-section and may include a number or structural sections as desired to provide supports for the tape storage area 307 and tape dispensing system 500. In alternate embodiments, the frame of the case sealing apparatus may have any other desired shape to suit the configuration of the transport system and dispensing system mounted from the frame.

The transport system 400 of the apparatus may include a transport support 402, a lower guide or guides 404 (in this embodiment shown as a pair of horizontally opposed rails) for contacting a lower portion of package A and for guiding package A along a desired process direction(indicated by arrow x in Fig. 1). Transport system 400 may also include a upper guide 406 for contacting and guiding an upper portion of package A, an entry shoe 408 and an exit shoe 409 for applying pressure to a top surface of package A and a conveyor system (not shown) for moving package A in the process direction (indicated by arrow x). The transport system 400 of the system shown in Fig. 1 and described above, is merely exemplary of a suitable transport system for transporting a package A in the dispenser. As can be understood, in alternate embodiments, the transport system of the dispenser may have any other suitable configuration for conveying and controlling the positional orientation of the package relative to the dispenser.

In this embodiment, distance between the rails 404 is adjustable for adjusting a width of passage. Rails are adjustable toward and away from each other to accommodate packages of different sizes. Rails may be adjustable by hand and may have handles to aid in adjustment. Alternate embodiment rails may be coupled to a drive system that moves rails toward or away from each other for adjustment. The transport support 402, in this embodiment generally has a bed of freely rotatable rollers arranged to provide a movable support area for the package A and allow the package to move under impetus from the conveyor system in direction X (see Fig. 2). In alternate embodiments, any suitable transport system may be used, including for example, a bed of bi-directionally rotatable rollers, transport pallets, an air cushion system or others. The conveyor system in this case may include a series of rollers coupled to a suitable drive motor. Other conveyor systems including a belt, a piston for pushing package A, etc. or any combination may be used. In other alternate embodiments, the sealing system may not have a powered conveyor system, the package being movable by hand through the dispenser.

In the embodiment shown in Fig. 2, tape-dispensing system 500 of the dispenser generally comprises upper and lower dispensing systems 500A, 500B. The upper and lower systems are generally similar, and will be described with particular reference to the upper system 500A. The upper system 500A generally comprises a tape storage 520, guide rollers 522, idler roller(s) 524 (only one is shown for example purposes), and a tape application head 526. Tape storage 520 is shown for example as being configured for holding a tape supply arranged in a roll or reel. Tape storage 520 may include a roll support post or drum 525

and one or more opposing support arms for holding a reel of tape 100 and allowing it to be fed to guide rollers 522 and idler roller 524. In alternate embodiments, the tape storage may be configured as desired to hold a tape supply arranged in any other suitable manner (e.g. horizontally stacked tape strips). Guide rollers 522 are generally positioned to guide tape 100 to tape application head 526. Idler roller 524 may be connected to a tension mechanism 535 that causes idler roller 524 to maintain tension to tape 100 during operation of the dispenser.

Referring now also to Fig. 2, there is shown a schematic elevation view of the tape application head 526. The tape application head 526 may, for example purposes, have a configuration that is generally similar to the tape dispensing section of the dispensing apparatus described and shown in US Patent Serial No. 6,474,392, which is incorporated by referenced herein in its entirety. Head 526 generally includes a tape feeding mechanism 16, a cutting section 18, and optionally a wetting system 20. Wetting system 20 may not be used for certain types of tape 100, for example, those with certain types of pressure sensitive or pre-activated adhesive as will be described further below. In alternate embodiments, the tape application head 526 may have any other desired configuration.

Feeding mechanism 16 generally comprises idler roller(s) 30, guide tray(s), feed roller, and drive motor (not shown). Idler roller(s) 30 (only one idler roller 30 is shown in Figure 2 for example purposes) are located in the application head 526 generally proximate to feed roller 34. Idler roller(s) 30, in cooperation with idler

roller(s) 524 (see Fig. 1), support and guide tape 100 in a feed direction indicated by arrow X1 to feed roller 34. As shown in Fig. 2, one or more guide trays 32 may be mounted in the proximity of feed roller 34. Guide trays are shaped and orientated such that tape 100 riding upon guide trays 32 is orientated true to feed direction X1 of feed mechanism 16, and aligned with feed roller 34. This prevents tape 100 from being skewed or twisted during feeding. Feed roller 34 may be drivingly connected by suitable transmission means (not shown) such as a belt, or chain drive to electric motor (not shown). The electric motor driving feed roller 34 may be energized under control of a controller, and when energized rotates feed roller 34 in a suitable direction (e.g. counterclockwise) to transport tape 100 in feed direction X1. In alternate embodiments, the feed roller may be manually motivated. Friction contact between feed roller 34 and tape 100 causes movement of tape 100. Feed roller 34 may be connected to a counter which can indicate the rotation of the feed roller, and hence, an amount of tape being fed. A counter may be operable to convey this information to controller. Feeding mechanism 16 described above and shown in Figure 2 is merely one example of a suitable feeding mechanism which may be used in tape dispensing apparatus 12 according to the present invention. The present invention is equally applicable to dispensing apparatus having any other suitable feeding mechanism such as, for example, a manually operated feeding mechanism, or a feeding mechanism adapted to feed tape with a pre-activated adhesive.

Referring also to Figs. 3A-3B, cutting section 18 includes a cutting mechanism 38. Cutting mechanism 38 is operated by controller (not shown) to cut tape 100 fed

past cutting section 18, and generally comprises cutting blade 40 and a blade actuator 42, 44. An example of a suitable cutting mechanism that may be used with the sealing system 10 in this embodiment is shown and described in US Patent serial No. 6,474,392 previously incorporated by referenced herein. In alternate embodiments, any suitable cutting mechanism may be used. Cutting blade 40, as seen in Figs. 3A-4B, may include a frame member 40F, and a blade member 40B. Blade member 40B is substantially flat and has a cutting edge 54. A blade tab 56 is mounted to a side 41B of the blade member. In this embodiment, blade tab 56 has a general U-shape with two sidewalls connected by a bottom wall. Alternatively, blade tab 56 may have any other suitable shape, such as for example, a V shape, or otherwise the sidewalls may not be connected. In this embodiment, sidewall 56B may be shorter than sidewall 56A (see Fig. 3A), though in alternate embodiments the sidewalls may have substantially the same length or terminate in substantially the same plane. A free edge 55, 57 of each sidewall is sharpened to form a cutting edge.

Cutting blade 40 is slidably supported in frame 11 by guide rails or any other suitable movable support system. Guide rails allow cutting blade 40 to slide in the direction indicated by arrow Z between an up position (shown in Figure 2), and a down position (not shown). Cutting blade 40 may be orientated generally transverse to tape 100 as the tape 100 is being fed by feed mechanism 16 past cutting blade 40. In addition, cutting blade 40 is positioned in frame 11 such that tape 100 is fed through opening 50 frame member 40F when cutting blade 40 is in the up position, and when in the down position, cutting edge 54 cuts completely through tape

100. As seen best in Fig. 3B, in this embodiment, the cutting blade 40 has a lower arm member that is connected by a pin (not shown) to one end of the blade actuator. In this embodiment, the blade actuator generally includes a spring loaded solenoid 42, and a pivot link 44. In alternate embodiments, any suitable actuator may be used for moving the blade including a hydraulic or pneumatic actuator, an electric drive, or a manual actuator. In this embodiment, pivot link 44 is pivotally mounted to frame of the application head. One end of the link 44 is pinned to the lower arm member of blade 40, and the opposite end of pivot link 44 is connected to an actuator stem 43 of the spring loaded solenoid 42. Spring loaded solenoid 42 is controlled by controller and operates to move actuator 43, and hence blade 40 via link 44, generally back and forth in the direction indicated by arrow Z. Although, in Fig. 2, the actuator stem 43 is shown substantially aligned with the blade 40, in alternate embodiments, the actuator stem, and indeed the drive may have any suitable orientation relative to the direction of movement of the blade during cutting action.

The optional wetting system 20 of apparatus 11 may be any suitable wetting system. One suitable example is shown and described in U.S. Patent No. 6,474,392 previously incorporated by reference herein. In the embodiment shown, the wetting system generally comprises a fluid reservoir or bottle (not shown), a basin or tray 84, a wetting brush 86 and a moisture shield 88 (see Fig. 2). Tray 84 is mounted to the frame after the cutting blade 40 in the direction of motion X1 tape 100, and is open at the top. Tray 84 of wetting system 20 holds a suitable wetting fluid for activating an adhesive on tape 100. Wetting brush 86 is located inside tray 84. A top 90 of

brush 86 projects above a lip of tray 84 (see Fig 2). The bottom of brush 86 sits in fluid in tray 84. Brush 86 is made of a material suitable for allowing fluid to be drawn by capillary action from tray 84 along the bristles of brush 86 to the top 90 of brush 86. The bristle density in brush 86 is sufficient to provide top 90 of brush 86 with a consistent wetting surface 92. Brush 86 is located in tray 84 so that the wetting surface 92 of brush 86 is generally coincident with the bottom surface of tape 100 being dispensed from application head 26. Accordingly, when tape 100 is dispensed the bottom surface of tape 100 contacts the wetting surface of wetting system 20.

Apparatus 11, if desired, may be provided with a heater element 94 (not shown) for heating a surface of the tape to enhance adhesive activation. The shield 88 of the optional wetting system allows for selectively wetting portions of the bottom of tape 100 dispensed from apparatus 12 in a manner similar to that described in US Patent No. 6,474,392 previously incorporated. Shield 88 may be a one piece member made from a sheet of suitable material, for example, stainless steel, though any other suitable material may be used including plastic. Shield 88 has a base member 87, and a tab or arm 89 depending therefrom. In alternate embodiments, shield 88 may have any other suitable configuration.

Shield 88 may be mounted to tray 84 as shown in Fig. 2, or to any other suitable section of the frame. Arm 89 of shield 88 is biased against the top 90 of brush 86 in tray 84. This presses a strip of the top 90 of brush 86 below wetting surface 92. Hence, when tape 100 is dispensed from tape apparatus 12, the bottom of tape 100

comes in contact with wetting system 92 but is otherwise prevented by shield arm 89 from contacting a strip on the top of brush 86. Thus, as the bottom of tape 100 passes across the top 90 of brush 86, the bottom of tape 100 has a strip 106 (see Fig. 1A) along its lower surface which is generally unwetted, while the sections 100A of the bottom of tape 100 on either side are wetted by wetting system 20.

Referring now to Figs. 4A-4B, there is shown respectively an exploded perspective view, and a top plan view of the tape 100 used with sealing system 10 in accordance with one embodiment of the present invention. Tape 100 may be generally similar to the tape described and shown in U.S. Patent Serial No.: 09/672,463 which as stated before is incorporated by reference herein. Though the description of the tape will be with particular reference to tape 100, section 100A, (see Fig. 1A) of the tape are substantially similar. Tape 100 in Figs. 4A-4B may be reinforced gummed paper tape, though as noted before any suitable type of tape may be used including plastic tape. In this embodiment, the tape generally has a top layer 110, a contact pressure layer 112, reinforcing strands 114A-114C, a bottom layer 116, and a ribbon 104. The top layer 110, and bottom layer 116 are made of suitable paper. In alternate embodiments, the top and bottom paper layers may be made of different paper. The top and bottom layers 110, 116 are substantially the same width. The pressure contact layer 112 may be a flexible, water resistant, non-staining layer. In this embodiment, tape 100 has an array of reinforcing strands 114A-114C in three directions. In alternate embodiments, the gummed tape may be reinforced in any number of directions, or may not be reinforced with reinforcing strands.

Reinforcing strands 114A-114C may be made of fiberglass, or any other suitable strand material of appropriate tensile strength, including plastic, or organic fiber (e.g. cotton). The ribbon 104 of tape 100 may be made from any suitable material such as plastic, such as metallic ribbon, non-metallic carbon fiber, or organic fiber. The ribbon 104 is provided with a suitable self-adhesive on one side 105. The ribbon may include on one side a suitable marking indicia 101, such as for example a desired alpha-numeric indicia pattern that may indicate any desired information such as for example, information on package contents, shipping information or security information. The indicia may be readable directly by the user, or may be electro-optically readable indicia, such as a barcode pattern. The indicia may also be a die or ink. The ribbon 104 may also include a radio frequency identification (RFID)transponders 113 otherwise, the RFID transponders may be disposed on a surface, such as an inner surface, of a tape layer 110, 116. The RFID transponders 113 may include any desired information transmitted to a suitable receiving system (not shown) when the RFID transponders are interrogated by the system.

Figures 5A-5E show another exemplary embodiment of tape 100 in accordance with the present invention.

In this embodiment, tape 100' generally includes a top layer 510, a bottom surface 512, adhesive 118, and ribbon 104'. In this embodiment, top layer 510 may be a laminate of one or more suitable materials, for example, paper, plastic, cloth, fiber, fiberglass, polymer, polypropylene, polyester, polyvinyl chloride, metal film,

a polymer plastic film, a composite of plastic polymer and paper, or any combination of suitable materials.

Adhesive 118 may be a pressure sensitive adhesive, for example an amorphous polypropylene laminate material which is non-asphaltic, such as that made by Huntsman Chemical, though any other suitable pressure contact material may be used. The adhesive 118 may be deposited on bottom surface 512 during or after manufacture of tape 100', by any suitable means, such as spraying, rolling, brushing, or a hot melting process. Alternatively, the adhesive may be a heat activated adhesive wherein the adhesive tackifyer is heat. The heat may be delivered to the dispensed tape 100' by the heating plate in the dispensing head described previously.

Ribbon 104' may be substantially similar to ribbon 104 as described above and shown in Fig. 4B and may have any suitable width and thickness dimensions. In this embodiment, ribbon 104' is applied to bottom surface 512 of tape 100' and bonded to bottom surface 512 by adhesive 118. In another embodiment, ribbon 104' may have a coating of adhesive 200 on top surface 105' for bonding to bottom surface 512 of tape 100'. Adhesive 200 may be the same as adhesive 118 or may be a different adhesive. Bottom surface 210 of ribbon 104' my be generally free of any adhesive. Bottom surface 210 of the ribbon 104' may have a marking indicia 101' thereon similar to indicia 101 described before. As shown in Figure 5B, ribbon 104 may extend beyond a forward edge 515 of top layer 510. In an alternate embodiment, ribbon 104' ends flush with forward edge 515.

Referring to Figure 5E, this embodiment of tape 100 may also include a start tab 120A located proximate end 124A of cut section 100A. Two substantially parallel slits 122A may be formed on either side of ribbon 104 to create start tab 120A. An area between slits 122A on bottom surface 512 is generally free of adhesive to facilitate lifting start tab 120A and a portion of ribbon 104 attached thereto. The action of lifting the portion of ribbon 104 applies force to tape 100 in an area of each slit 122A opposite end 124A of cut section 100A. In this embodiment, the concentration of force causes the laminate material of top layer 510 to fracture along the longitudinal edges of ribbon 104, allowing the laminate material to tear along the longitudinal edges and separate into two separate pieces.

Referring now again to Figures 1, and 2, a user may dispense tape 100, 100' from dispensing apparatus 11 as described below. As noted above, tape 100 is loaded into storage area 520. Water may be added to optional wetting system 20 if wetting system 20 is present and required for wetting tape 100. A user energizes apparatus 10 which initiates the controller (not shown). Using user interface 600, the user may program the controller to dispense tape 100 into sections such as sections 100A (see Fig. 1A) having a desired length. System 10 may also include contacts or other sensors to indicate the system controller that package A is in position for application of tape 100 to the package. Feed system 16 (see Fig. 2) operates to feed tape 100 in the feed direction X, past the cutting blade 40 which now is in the up position. If wetting system 20 is present and being utilized, tape 100 continues in the feed direction (indicated by arrow X1 in Figure 2) to wetting system 20.

Wetting system 20 may not be used with pressure sensitive tape 100'. Shield 88 is generally aligned with ribbon 104 of tape 100. Arm 89 is sufficiently wide to cover ribbon 104. As tape 100 is being fed, wetting surface 92 of brush 86 brushes against surface 102 of tape 100, except in the area of shield arm 89. Shield arm 89 prevents a portion of bottom surface 112 of tape 100 from coming into contact with brush 86. This forms a strip 106 as the tape 100 is fed where surface 112 is not wetted (see Figure 1A). Ribbon 104 of tape 100 is located on strip 106. Moisture from wetting surface 92 deposited on tape 100 activates adhesive 102 except on strip 106. If desired, heater element 94 may have been previously activated to heat the water in tray 84 and on brush 86 to a desirable temperature. This enhances the activation of adhesive 102 on surface 112 except on strip 106. The moisture activated adhesive 102 in the area of strip 106 remains dry and inactive. When the controller senses, from counter 35, a desired length of tape 100 has been dispensed, the controller de-energizes spring loaded solenoid 42. This brings cutting blade 40 down and cuts tape 100 into a section such as section 100A. Cutting blade 40 cuts tape 100 transversely across, to form a tape section 100A (see Fig. 1A) of predetermined size suitable for sealing the open seam of the package A. During actuation of the cutting blade 40 to cut the tape 100, to form the length of tape 100A dispensed by system 10, the cutting edges on blade tab 56 (see Fig. 3A) form slots 122A in the cut end 124A of tape 100. The slots cut end 124A of slots are formed adjacent to strip 106, and define a pull tab 120A for the strip. In a similar manner a pull tab 120A' is formed in the end 124A' of tape 100' (see Fig. 5E).

The tape dispensing system and transport system are synchronized so that the tape 100 is dispensed from the exit area 26 at a corresponding time at which the package A is moved past the opening. Accordingly, the dispensed tape comes into the contact with the package A surface and continues to be dispensed as the package is moved under the opening. The tape 100 is thus place over the opening. Contact rollers depending from the frame 500 may be used to ensure the open seam in the package is minimized and to apply contact pressure to the tape as the package A is moved by the transport system to ensure adhesion between the tape 100 and package. Similarly, the lower portion 500B of the tape dispensing system operates to apply tape to a bottom seam of the package. The tape dispensed by the lower section 500B of the tape dispensing system may not have an easy to remove tear strip as tape 100 in the upper section of the tape dispensing system.

As shown in Fig. 1A, when desiring to open seam E' of the package A, the user merely lifts and pulls on start tab 120A (see also Figs. 4B and 5E) of the tape section 100A. The start tab 120A which is part of unbonded strip 106 is also not bonded to the package A and may be readily lifted and pulled by the user. The tab 120A is pulled in the direction indicated by arrow Y in Fig. 1A. Pulling the start tab 120A, which has a portion of ribbon 104A thereon, in turn, pulls ribbon 104A in strip 106A thereby tearing of the tear strip 108 from the tape 100 and opening seam E'. Tear strip 108 tears easily because the strip 106A which forms the tear strip 108 is not bonded to the package. This allows the pulling force delivered by the user to be transmitted in part, in tearing the tape, rather than pulling against the adhesive holding

the tape 100 on the package A. Moreover, ribbon 104A which is on strip 106 is also free to lift off the package, and provides mechanical advantage to break reinforcing strands (similar to strands 114B, 114C in Fig. 4B) of the tape 100. In alternate embodiments, the tear strip may have adhesive bonding the strip to the package surface. However, in these embodiments the tear strip will still tear free from the package and tear the tape under the mechanical advantage of ribbon 104A prying the strip. As can be seen in Fig. 1, the tearing of the tearing strip 108 from the tape section 100 applied to package A, preferably causes permanent, visible damage to the tape section 100 in the form of the uplifted, and torn strip 108. Accordingly, this provided an indication to a recipient user receiving the package A, that the package A may have been tampered with. Thus, it is also within the scope of the exemplary embodiment to provide a security system (see Fig. 1) for packages, wherein the tape 100 applied to the package A as described previously gives an indication to the user, such as by the visibly torn strip 108, that the package A has been tampered with. Once tear strip 108 has been torn, the tape section cannot be restored to its original condition, and the evidence of tearing will remain visible to a user. Further any dies or inks on ribbon 104 may be released, thereby becoming visible even if an attempt is made to repair torn strip 10B.

Referring now to Fig. 6, there is shown an exploded perspective view of a sealing system 1010 in accordance with another exemplary embodiment. The sealing system 1010 in this embodiment is generally similar to sealing system 10 described before and shown in Figs. 1-5. Accordingly, similar features are similarly numbered.

System 1010 generally comprises a dispenser 1011 for dispensing material such as tape 100''. The present invention is equally applicable to any desired type of material dispenser, including material dispensers other than sealing tape dispensers. Tape 100'' may be similar to tape 100,100' and will be described in greater detail below. Dispenser 1011 is shown in Fig. 6 as being a case sealer for example purposes, and in alternate embodiments may have any other suitable configuration. As seen in Fig. 6, dispenser 1011 generally comprises support structure 1300, a transported package guide section 1400 and a material dispensing system 1500. In this embodiment, the material dispensing system 1500 is configured for holding and dispensing tape 100''. In alternate embodiments, the material dispensing system may be configured to dispense any suitable flat material sheets. The support structure 1300, is generally similar to support structure 300 described before, and includes any suitable number of support posts, braces and beams for supporting the other components of the dispenser 1011. The transport section 1400 may include lower guide(s) 1404 and upper guide(s) 1406 for orientating a package, similar to package A (see Figs. 1-1A) with respect to the dispenser 1011. The transport section 1400 may also include a package transport bed, similar to the bed of rollers 402 in Fig. 1, for moving the package in a process direction indicated by arrow X in Fig. 6. Tape dispensing system 1500 is also generally similar to the dispensing system 500 shown in Fig. 1. Dispensing system 1500 may include upper and lower tape dispensing sections 1500A, 1500B for taping and sealing substantially at the same time opposite sides of the package. In alternate embodiments, the dispenser may have any desired number of dispensing sections. The

upper and lower dispensing sections 1500A, 1500B are similar and will be described below with specific reference to the upper section 1500A.

Upper dispensing section 1500A, as shown in Fig. 6, may have a tape storage area 1525, idler/guide roller(s) 1030, feed roller(s) 1034 and a tape application head 1526. As shown in Fig. 6, the storage area 1525 may be a freely rotatable post or drum 1525 capable of supporting a roll R of tape 100''. As noted before with respect to dispenser 11 in Fig. 1, in alternate embodiments the tape storage area may have any other desired configuration to hold the dispensed material arranged in configurations other than a roll. As seen in Fig. 6, the tape storage 1525 is supported on an arm member 1307. Arm member 1307 may be pivotable and biased by suitable means such as a tension spring (not shown) in the direction indicated by arrow θ. The bias of member 1307 provides tension to tape 100'' dispensed from area 1525. In alternate embodiments, the storage area 1525 may include an integral tensioner, such as torsion spring on the drum, or brake to maintain tension on the tape 100'' during dispensing. Guide roller(s) 1030, and feed roller(s) 1034 (only one guide and feed roller are shown in Fig. 6 for example purposes) operate in concert to feed tape 100'' to the tape application head 1526 of the dispenser. As seen in Fig. 6, tape application head 1526 is located to direct the tape dispensed from dispenser on to the surfaces (similar to panels B and L in Fig. 1A) of the package. One or more applicator rollers 1031 aids in applying the tape to the package surface. The tape application head 1526 dispenses the desired length of tape. The tape application head 1526 is generally similar to application head 526 described before and

shown in Fig. 2. Application head 1526 includes a cutting mechanism 1518 that is operably connected to a controller (not shown). The controller sends a signal to effect operation of the cutting mechanism 1518 thereby cutting the dispensed tape at the desired length upon receiving a signal from a suitable sensor (not shown) that the desired length of tape has been dispensed. The cutting mechanism includes a cutting blade, similar to blade 40 (see Figs. 2 and 3A-3B) that includes cutting edges projecting from the blade, similar to tab edges 55 (see Figs. 3A-3B) for cutting longitudinal slots in the dispensed tape 100A'' (similar to slots 122A in Figs. 4B, 5E). This as will be described further below, forms a pull tab (similar to tab 120A in Fig. 4B) for a tear strip formed on dispensed tape 100A''.

In this embodiment, the tape application head may not include a tape wetting system (such as wetting system 20 of head 526 shown in Fig. 2). For example, tape 100'' may be tape generally similar to tape 100', described before and shown in Fig. 5A-5C. Tape 100'' may have a layer similar to base layer 510 (see Fig. 5A) made for example of plastic, or any other suitable material. One surface of the layer 510 (similar to surface 512) may have a pressure sensitive adhesive similar to adhesive 118. In alternate embodiments, the tape 100'' may comprise multiple layers, similar to the embodiment shown in Fig. 5D. In other alternate embodiments, tape 100'' may be paper tape, such as for example reinforced, or unreinforced gummed paper, similar to tape 100 shown in Fig. 4A. In the case tape 100'', is gummed tape, the dispenser 1011 may be provided with a wetting or adhesive activation system as will be described below.

As seen in Fig. 6, the sealing system 1010 includes removable interchangeable modules 1710, 1710A (only two modules 1710, 1710A are shown in Fig. 6 for example purposes, and the system may include any number of modules). Each of the modules 1710, 1710A may be capable of adding a different desired element to the tape 100'' during dispensing, as will be seen further below. The modules 1710, 1710A are mountable to the support structure 1300 of the dispenser 1011. The user selects a module 1710, 1710A according to which desired element is to be added to the dispensing tape, and mounts the module on the support structure. The user then operates the dispenser to dispense tape 100', and the module 1710 mounted on the dispenser operates to add the desired element to the tape as it is being dispensed.

Still Referring to Fig. 6, the removable modules 1710, 1710A may have some features that are common to all modules, such as for example a support frame 1714, 1714A, with a mounting surface for mounting the removable module to a support surface(s) 1302 of the dispenser support structure 1300. Also, the removable modules 1710, 1710A may have an application area, exit or aperture 1712, 1712A that is so positioned when each of the respective modules is mounted to structure surface 1302 for the additional element to be applied to tape 100'' as it is being dispensed. Although in this exemplary embodiment it is shown that the entire module is removable, in alternate embodiments the modules may have a portion fixed to the dispenser structure and a removable portion.

By way of example, and with reference also to Figs. 7A-7B, respectively showing partial perspective views of part of dispenser 1011 and a representative selectable

module 1710 as seen from opposite directions. Module 1710 is of a type capable of adding an element such as supplemental layer, ribbon or any other desired longitudinally extended material. Referring also to Figs. 9A-9B, respectively showing another perspective view, and an exploded perspective view of an exemplary module 1710, having a frame 1714 that is removable substantially as a unit. In alternate embodiments, the frame may be subdivided into portions that may be snapped together and separated from each other thereby allowing a portion to remain fixed to dispenser structure while another portion is removed. The frame 1714, in this embodiment, may generally include in this embodiment, outer side walls 1720 and cross braces or members 1722, 1724, 1726. In this embodiment, the frame or casing 1714 is generally open, providing ready access to module components between the frame walls. In alternate embodiments, the module frame or casing may have any other desired shape, and may be either open or closed. The frame 1714 may be either metal, plastic or any other suitable material. The side walls 1720 may be stamped or molded. The bottom of the side walls 1720 may be formed substantially flat, or may be machined, to provide seating surface 1716. The seating surfaces 1716 are provided with a complementing attitude relative to mounting surfaces 1302 of the dispenser support structure 1300 (See Figs. 7A-7B) to position the application area 1712 of the module in the desired location on the dispenser, when the module is mounted to the dispenser. The frame 1714 has a locating feature 1728 for longitudinally locating the module 1710 on the dispenser structure. In this embodiment, each side wall 1720 has a tab 1730 to form the locating feature 1728. The tabs 1730 have a surface which abuts a surface 1303 of the

support structure (see Fig. 7B) to locate the module 1710 on the dispenser. The mechanical stops provided by tabs 1730 provide an effective, reliable locating system allowing for ease of installation of the module. In alternate embodiments the locating feature may be provided using any other suitable means. Cross members 1722, 1724, 1726 provide rigidity to the frame 1714. The cross members 1722, 1724, 1726 are shown as being pins or rods, but may have any suitable form. The cross members 1722, 1724, 1726 may be mechanically mounted to the sidewalls 1720, such as for example using screws or other fasteners, or may be staked or pinned to the sidewalls. As seen in Figs. 9A-9B, in this embodiment, cross members 1724, 1726 are mounted at the front 1714F of the frame, and cross member 1722 is mounted at the rear 1714R. In alternate embodiments, any suitable number or arrangement of cross members may be used.

As seen best in Fig. 9A, the frame 1714 of the removable module 1710, defines a storage area 1740 for holding a supply of the additional element to be applied to tape 100'' when being dispensed. In this embodiment, the storage area 1740 holds a supply or ribbon 104B. As seen in Figs. 9A-9B, in this embodiment the storage area 1740 includes a spindle shaft 1742 capable of holding thereon a roll R104 of ribbon 104B. As shown in Fig. 9B, spindle shaft 1742 may include a support pin 1744, bushings or collars 1746 and outer cylinder 1748. The support pin 1744, may be made from any suitable material (e.g. plastic, metal) and may be solid or hollow. The pin 1744 spans between the sidewalls 1720, and is configured to be seated in slots 1750 (see Fig. 9B) of the side walls. The ends of the pin 1744 may be provided with a locking groove 1752 to laterally lock the pin in the frame 1714.

In alternate embodiments, any suitable locking means may be used to hold the pin in the module frame. Bushings 1746 are mounted to opposite ends of the pin. The bushings may be made of any suitable plastic (i.e. Delrin™) or metal (oil impregnated bronze) to provide a lubricious sliding surface against pin 1744. A suitable tensioner (not shown) such as a torsion spring or other torsional resilient element, or brake may be interposed between bushings 1746 and pin 1744 to provide tension on ribbon 104B during dispensing. Bushings 1746 are each provided with a collar 1746C to mate the outer cylinder 1748 to the bushings. The outer cylinder 1748 of spindle shaft 1742 is thus supported by and rotates with the bushings. As seen in Fig. 9A, roll R104 of ribbon 104 is seated on the outer cylinder 1748. As can be realized, in alternate embodiments the storage area 1740 of the removable module may be arranged in any other desired manner to hold the supply of the additional element according to the disposition in which the supply is provided. For example, a tray may be provided to hold an array of stacked ribbons. As can be realized from Fig. 9A, the spindle shaft 1742 may be readily removed from frame 1714, thereby readily removing the supply of the added element (i.e. roll R104) by lifting the shaft 1742 (in the direction indicated by arrow O in Fig. 9B) out of slots 1750. This allows for rapid replacement of a spent supply, as well as the swapping of different elements. Hence, in accordance with the exemplary embodiment, not only are different removable modules 1710, 1710A readily interchangeable, but the different additional elements being added to the dispensing tape, are themselves readily interchanged within a given module 1710.

Referring again to Fig. 7B, and by way of example, module 1710 in this embodiment holds a supply (roll R104) of ribbon 104B. Ribbon 104B may be any suitable longitudinally elongated material such as tape or ribbon. Although in this embodiment ribbon 104B is shown as being of smaller width than tape 100'', in alternate embodiments, the ribbon 104B may be similar to ribbon 104, 104' described before and shown in Figs. 4A, 5A. Accordingly, ribbon 104B may be plastic (such as biaxially oriented polypropylene (BOPP) or mono-axial polypropylene (MOPP)) ribbon, metallic ribbon, non-metallic carbon fiber, or organic fiber. As noted above, the ribbon may have any desired width and thickness corresponding to a desired use. For example, if the ribbon 104B is being applied to tape 100'', to provide the tape with added reinforcement, a wider ribbon may be used. Otherwise, if the ribbon 104B is to provide little reinforcement, but a tear out element is desired, then possibly a less wide ribbon may be used. The ribbon 104B may be provided with a suitable pressure sensitive adhesive 105B (see Fig. 7B) on one side to facilitate adhesion to tape 100'', especially when tape 100'' is gummed tape. Further, similar to ribbons 104, 104A, ribbon 104B may have a desired marking indicia thereon (e.g. an alpha-numeric pattern or an electro-optically readable pattern). Ribbon 104B may otherwise include a die or ink to provide a tamper proof feature to dispensed tape 100A'' (the die to be released, or become visible once the dispensed tape 100A'' is torn from the package on which the tape is applied). Further, ribbon 104B may include RFID transponders, similar to transponders 113, with any desired information encoded thereon. The above listed examples of the type of ribbon 104B that may be used in module 1710 are not meant to be inclusive, and in

other alternate embodiments the ribbon 104B may be of any other type. As may be realized the different examples of ribbon may be provided in different interchangeable ribbons that may be arranged for example in rolls similar to roll R104. Fig. 6 shows module 1710 with ribbon 104B loaded in the module frame, and a different interchangeable ribbon 104C arranged in a roll R104C. When desired, the ribbon 104B in the module 1710 may be replaced with another interchangeable ribbon 104C by lifting the spindle shaft 1742 (in the direction indicated by arrow O in Figs. 7A-9B) and replacing the roll on the shaft. The shaft may then be seated again in the frame. In the above noted manner, any desired additional element may be added to tape 100'' when being dispensed.

Still referring to Figs. 9A and 9B, the application area 1712 of the removable module 1710 may correspond, at least generally, to the type of ribbon 104B being dispensed. In the embodiment shown in Figs. 9A-9B, the module 1710 has a grooved roller 1750. The roller 1750 may be rotatably supported on cross member 726, though in alternate embodiments, the roller may be supported in any other desired manner. The groove 1756 in roller 1750 is generally conformal to the shape of ribbon 104B and provides directional stability to the ribbon as it is being fed from the supply in the removable module 1710. The lateral location of the roller 1750 may be held by clamps or snubbers 1752. In this embodiment, the clamps 1752 are mounted onto member 1726 and fixed by set screws 1754. The position of the clamps 1752 on member 1726 may be adjusted, thereby adjusting the lateral position of roller 1750. As seen best in Figs. 7A, 7B, the ribbon 104B is extended from the roll in the storage area 1740

of the module, around roller 1750 to exit 1712 of the module. Referring also to Fig. 8, which shows a schematic elevation of module 1710 on the dispenser 1011, after placement of the module 1710 on support structure 1300, the ribbon 104B exiting from application area 1712 may be fed into the feed roller(s) 1034 of the dispenser. As seen in Figs. 7A-7B and 8, the ribbon 1048 extending from the module, contacts tape 100'' and with the tape passes around idler roller 1030 and feed roller 1034 in an arrangement configured to generate substantially uninterrupted contact between the tape 100'' and ribbon 104B. The tape 100'' is fed from roll R so that the adhesive face 118'' of tape 100'' faces the ribbon 104B. In the case, tape 100'' has pressure sensitive adhesive on face 118'', contact pressure between ribbon and tape as both pass around rollers 1030, 1034 is adequate to bond the ribbon to the tape. If tape 100'' is gummed tape, the adhesive on face 118'' may be inactive, but the ribbon 104B may be provided with a pressure sensitive adhesive on side 105C (see Fig. 7B) of the ribbon 104B which again is adequate to bond the ribbon to tape 100'' as they pass around rollers 1030, 1034. In the event tape 100'' is a gummed tape. The removable module 1710 may be provided with an optional wetting system similar to wetting system 20 of application head 526 shown in Fig. 2. In an alternate embodiment, the optional wetting system, similar to wetting system 20 in Fig. 2, may be included in the application head 1526 of the dispenser (see Fig. 6).

As may be realized, the tape 100A'' dispensed by the dispenser 1011 and applied to seal seams similar to seams E' on package A (see Fig. 1A) may be configured as desired when being dispensed, by mounting the desired

interchangeable module 1710, 1710A on the dispenser, or by using the desired material supply 104B 104C in the module. The dispensed tape 100A'' may include a tear strip, similar to strip 106 in Fig. 1A, which has ribbon 104B thereon. Upon tearing of the tear strip, the ribbon, depending on which ribbon was selected, may release an ink or die, make a marking indicia visible or readable, or provide some other indication that the package seals have been tampered with.

Although, module 1710 has been described above as being arranged for dispensing a longitudinally elongated material, in alternate embodiments the interchangeable module may be able to apply any other desired material to tape 100'' as it is being dispensed. For example, module 1710A may have a casing configured for holding a supply of a desired liquid or powder element, such as an adhesive, a die or ink. The liquid supply may have suitable feed channels (not shown) directing the liquid from the supply to the application element 1712A (such as for example a roller or brush). The module may have a connector (not shown) for connecting the module to a power supply (not shown) for example to heat the supply or power the application element 1712A. When the module 1710A is mounted to the support structure 1300, the application element is located to apply the liquid or powder element, by direct contact transfer or other media transfer, to the tape surface

Referring now to Fig. 10, there is shown a schematic elevation view of another sealing system 2010 in accordance with another exemplary embodiment of the invention. In general, system 2010 is similar to systems 10 and 1010 described before. In this case, however, the

dispenser 1001 may be a portable dispenser capable of being placed on a work surface T such as a bench or countertop.

An example of a suitable dispenser that may be used in this exemplary embodiment is described and shown in U.S. Patent No. 6,474,392, previously incorporated by reference. Dispenser 2011 has a support frame or casing 2300 that defines storage area 2500 which, as shown in Fig. 10, is arranged to hold a supply of tape 100''' provided in a roll. The dispenser 2011 also has a tape feed system, with guide roller(s) 2030, 2032 and feed roller(s) 2034, and a cutting mechanism 2018 for cutting the tape fed from the supply. Dispenser 2011 may include an optional wetting system 2020, as shown in the embodiment illustrated in Fig. 10, used in the case tape 100'' is gummed tape. Tape 100''' used with system 2010 is similar to tape 100'' described before. Similar to dispenser 1011, dispenser 2011 has an interchangeable module 2710 mounted therein that is selected from a number of interchangeable modules 2710A (only two interchangeable modules are shown in Fig. 10 for example purposes, though system 2010 may include any desired number of interchangeable modules). Each interchangeable module 2170, 2710A has a different material or element that may be applied to tape 100''' when being dispensed to provide the dispensed tape 100A''' with a desired property. In this embodiment, the interchangeable modules are illustrated as being bobbins or reels 2714 that hold a supply of ribbon 104B', 104C'. Ribbon 104B', 104C' is substantially similar to ribbon 104B described before. Reel 2714, as seen in Fig. 10 is configured to be rotatably seated on a bracket or mount 2306 formed on dispenser frame 2306. A holding clamp or fixture 2728

may be provided to hold the reel 2714 in the mount 2306. The clamp 2728 may have engagement tabs to catch complementing edges 2303 on the frame 2300 (see Fig. 10). With reel 2710 on mount 2306, the clamp 2728 may be placed over the reel and engagement tabs 2730 engaged with edges 2303 to hold the reel in the mount. The clamp 2728 is resilient flexible thereby providing tensioning means on the reel. Also, the engagement tabs may be deflected, either by pulling the clamp or squeezing the clamp, to disengage the tabs from the frame and release the reel 2710 from the dispenser. During operation of the dispenser 2011, ribbon 104B' is drawn from the reel 2710, and is mated with the 100''' by passing between rollers 2032, 2034. Accordingly, tape 100A''' dispensed by the dispenser includes ribbon 104B', 104C'. The dispensed tape 100A''' is cut by cutting mechanism 2018 to the desired length. The blade 2040 of the cutting mechanism has tab 2056, similar to tab 56 shown in Figs. 3A-3B , with cutting edges 2055 for forming a pull tab for the tear out strip similar to tabs 120A, 120A' in Figs. 4B and 5E. As in the other dispensers, the pull tab is formed when cutting the length of tape dispensed.

Referring now to Fig. 11, there is shown another sealing system 3010 in accordance with yet another exemplary embodiment. System 3010 is again generally similar to systems 10, 1010, 2010 described before. In this case, the dispenser 3011 is a hand holdable dispenser. The dispenser structure 3300 has a handle allowing an operator to hold the dispenser in her hand. The dispenser 3011 has a tape feed system 3500 with a tape storage 3525 and a feed roller 3034. The feed system is operated by the user, placing the tape 100^{IV} on feed roller 3034 in contact with a side of a package, similar

to package A in Fig. 1A, and drawing the dispenser in a direction along the handle 3310. As seen in Fig. 11, system 3010 includes a number of interchangeable bobbins or reels 3710, 3710A. Each reel 3710, 3710A may have a different ribbon 104B'', 104C'' stored thereon. Ribbon 1048'', 104C'' is substantially similar to ribbon 104B, 104C described before. A user, selects a desired reel 3710, and rotatably mounts the reel on the dispenser frame as shown in Fig. 11. The reel 3710 feeds the ribbon onto tape 100^{IV}, contact between the ribbon and tape, as the tape and ribbon pass around roller 2034 cause the ribbon to adhere to the pressure sensitive adhesive on side 118 of the tape.

The dispenser 3011 further includes a blade 3040 for cutting a desired length of time $100A^{IV}$ during dispensing. The dispensed tape 100^{IV} is similar to other dispensed tape 100A'' described above, including a tear strip similar to strip 106 and a pull tab (not shown) similar to tab 120A. Blade 3040 of dispenser 3011 includes cutting edges (not shown in Fig. 11) similar to the edges formed by tab 56 on blade 40 in Fig. A, and able to form the pull tab for the tear strip when the dispensed tape is cut.

It should be understood that the foregoing description is only illustrative of the invention. Various alternatives and modifications can be devised by those skilled in the art without departing from the invention. Accordingly, the present invention is intended to embrace all such alternatives, modifications and variances which fall within the scope of the appended claims.